



Workplace-Based Vocational Training in Central and Eastern Europe - Evidence on the School to Work Transition of Hungarian Apprentices

Daniel Horn

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Daniel Horn
Center for Economic and Regional Studies, HAS and ELTEcon
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Abstract:

Although apprenticeship training has been praised for its effectiveness in smoothing the school-to-work transition of non-college bound students in Western European dual education systems, there is a lack of evidence from Central Eastern Europe. Using a unique individual-level panel database, which includes an extensive set of controls, the study shows that Hungarian students of the non-college bound vocational training track with workplace-based training, have about 10-15% higher probability of initial employment, compared to similar graduates from the same track, who were trained in school. This effect seems to be stable across industries, and robust to specification checks.

keywords: workplace-based training, apprenticeship, non-dual systems, school-to-work transition

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1. Introduction²

There is a serious lack of studies on the effectiveness of workplace-based vocational training in Central-Eastern Europe (but see Baranowska, Gebel, and Kotowska 2011; Noelke and Horn 2011). Although, it has been widely argued that workplace-based training helps preparing non-college bound youth for the labor market, the arguments are almost solely based on studies from Western Europe, mostly from dual vocational education and training (VET) systems. These studies show that secondary level education systems, combining school-based vocational education with employer-provided, workplace-based (apprentice) training, have sustained a positive track record in smoothing the school to work transition process, lowering the unemployment rate, and increasing the quality of work (Rosenbaum et al. 1990; Müller and Shavit 1998; Shavit and Müller 2000; Ryan 2001; Breen 2005; Wolbers 2007; Wolter and Ryan 2011; Piopiunik and Ryan 2012). Besides the lack of empirics from Central-Eastern Europe, existing empirical research provides little information about the causal effect of apprentice training on school-to-work transition.

The paper improves on the existing literature in these aspects. Firstly, it provides information on the effectiveness of apprentice training from a non-dual education system in a Central-Eastern European country, Hungary. Secondly, there has been only a handful of studies that tried to show the causal effect of workplace-based training on labor market outcomes (Bonnal, Mendes, and Sofer 2002; Bertschy, Cattaneo, and Wolter 2009; Parey 2009; Noelke and Horn 2011) and all but one of them used evidence from dual education systems in Western Europe. This paper backs up these causal finding by adding more robust empirical support to the assumed positive causal link, emphasizing that workplace-based training might be beneficial in a non-dual system as well.

2. Apprenticeship training in Central-Eastern Europe

While apprenticeship training is usually associated with the dual-education systems, most of the Central-Eastern European (CEE) countries have also had experiences with workplace-based vocational training (West 2013). While in the dual systems – such as Germany, Austria, Switzerland or Denmark – the industry/business and the education sectors cooperate closely in the coordination of the vocational segment of education, in non-dual systems this cooperation is less developed. More precisely, in many CEE countries – especially in countries with strong pre-war linkages to the Austrian-German tradition of dual education system, such as Hungary, Slovakia or the Czech Republic – apprentice training, that was established during the pre-war period, had continued during the

² Abbreviations in the text: Central-Eastern Europe (CEE), Hungarian Life Course Survey (HLCS), National Assessment of Basic Competencies (NABC), vocational education and training (VET), vocational training track (VT), special education needs (SEN)

socialist era as well, but its essence has changed dramatically, and has much less resemblance today to the traditional dual systems.

The nature of apprenticeship training in socialist countries was changed mainly due to the huge national enterprises, as compared to the pre-war network of smaller independent firms and businesses, where apprenticeship training had originated. The provision as well as the content of training changed markedly. Also since the competitive market was demolished, and people were essentially guaranteed a job, having an early work-experience mattered much less both for the individual and the firm, which decreased the motivational aspects for both parties (see West 2013 for a comprehensive review of the transition of the CEE VET systems). Under the socialist era the students spent most their practical training time in large enterprises, rather than being in contract with several smaller factories, but at the same time not being jointly educated in shared off-the-job facilities, as in the dual apprentice training systems (Kogan 2008)

Moreover, although the post-transition changes in these countries have seen the demolition of the national enterprises and the revival of small businesses, the development of the education system was highly decentralized (Horn 2010), and thus the central coordination of vocational workplace-based training between business and the state was secondary, at best. “In the beginning of the privatization and restructuring processes in CEE countries [...], employers largely withdrew from the provision of training opportunities as they were not able to maintain the training infrastructure or afford the financing of apprentices. This led to general disarray in the education and training system, and the dismantling of well-established links between schools and enterprises.” (Kogan 2008, 21). The loss of these links has led to the alteration of the basic curricula, the divergence of the taught material and the up-to-date requirements of the workplace, and meant that obtaining workplace-based practical training for students has become a challenge. Theoretical and general elements in the curriculum were strengthened, which created – or prevented from destruction – new teaching places at the vocational schools (West 2013, 52). Although there are convincing arguments that increased focus on general skills is inevitable, if the aim is to increase youth employment (e.g. Köllő 2009), the effects of the assumed divergence of firms’ skills requirements and vocational curricula is unknown. In other words, we know little about the effect of workplace-based apprentice training (where, supposedly, more practical skills are acquired) on labor market outcomes as opposed to school-based training, *ceteris paribus* other individual characteristics, such as general skills.

While there has been extensive research on apprenticeship training in Western European countries (see comprehensive reviews by Wolter and Ryan 2011; or Eichhorst et al. 2012), there are not many

that look at Central and Eastern Europe. Also getting comparable statistics is difficult due to the different understanding of apprenticeship training: many CEE countries refer to their vocational training programs as apprentice training programs, although students don't have any contractual agreements with firms (Kogan 2008, 21–22), or label non-formal forms of training as apprentice training³.

To my best knowledge there have been only two comprehensive reviews on the vocational education sector in Central and Eastern Europe. Kogan, Gebel and Noelke (2008) have relied on local expertise for their “handbook” to describe the general education system, including its VET, of the given country. With this local help they have categorized the countries into “school-based” or “dual” VET (see table 1 below).

Table 1. The predominant form of organization of VET

	School-based	Dual system
Bulgaria	X	
Czech Republic		X
Estonia	X	
Hungary		X
Latvia	X	
Lithuania	X	
Poland	X	x
Romania		X
Slovakia	X	x
Slovenia	x	X

source: Kogan et al. (2008, p. 22)

West (2013), on the other hand focused solely on the VET system but used desktop research to review the change of the local VET during the transition. As he notes “Poland seems to be the only country with a sizeable and distinct apprenticeship sector, accounting for something like 15 per cent of IVET students. Smaller ‘revived’ apprenticeship arrangements are present in Latvia, Slovenia and Croatia, organized through craft chambers, and half of the (comparatively low number of) Hungarian basic vocational school students have individual contracts with employers for their work experience. A number of countries (Estonia, Lithuania, Romania) have recently introduced regulations to recognize apprenticeship as an educational form, but take-up so far seems very limited.”(West 2013,

³ “Apprenticeship — Nauka zawodu u pracodawcy: Apprenticeship in Poland can take one of two forms: practical training at the employer’s, with theoretical knowledge completed in formal basic vocational school; or in non-formal forms to acquire qualification as an apprentice or skilled worker, such as training at the employer’s premises to perform a specific job, covering only selected work activities.” (CEDEFOP 2011, 57)

52). Thus it seems from these two sources that apprenticeship training is still significant in the previous Austro-Hungarian empire countries and in Poland (with strong linkages to Germany), even though apprenticeship training (or dual-education) might not mean the same as in Western Europe.

Looking at official statistics is less helpful due to the lack of comparable education data on apprenticeship training, and due to the different understanding of the term. On the other hand, one might approach training from the other direction, from the business sector. Table 2 below shows the training enterprises as percentage of all enterprises. Apparently the typical dual education systems of Austria, Denmark or Germany are all above the EU mean. But the conclusion from this table is less straightforward. Firstly, this statistic is also high in non-dual Western countries (as the UK or Sweden and Finland), and secondly, countries from Central and Eastern Europe are scattered along the distribution (although on average below the EU mean). Note, however, that – with the exception of Estonia – all ex-Austro-Hungarian empire members have higher percentages of training firms than the other CEE countries. This also points toward the fact that workplace-based training can be important in the CEE countries, and especially in those, where dual-training have a tradition. But whether apprentice training is just as effective in this region as it is in the Western dual economies is yet unclear.

There are but a couple of studies that look at the labor market outcomes of apprentice or workplace-based vocational training in CEE countries. Baranowska et al. (2011) – looking at the transition probabilities of Polish youth into fixed-term contracts - showed that *technicum*⁴ graduates with firm-based training do not have decreased risk of entering fixed term contracts as opposed to *technicum* graduates with school-based training. However, firm-based training in lower levels vocational programs appears to be more effective, which might be due to its longer duration and occupational specificity.

Noelke and Horn (2011) attempts a causal analysis, when looking at the effects of apprenticeship training in Hungary after the transition. Utilizing the fact that the ratio of apprenticeship places have decreased at a different pace within the 20 Hungarian counties, they perform a difference-in-difference analysis, and compare the labor market entrance of the vocational training school graduates between counties and years. Their conclusion is that in counties, where apprenticeship training declined less rapidly, youth unemployment also declined less; *ceteris paribus* cohort and year fixed effects and several additional county level controls. They, thus, conclude that apprenticeship training increased employment chances. Note that they could not find the same effect on the quality of the gained occupation.

⁴ Vocational training that provides the *matura* (school leaving certificate) at the end.

Table 2. Training enterprises as % of all enterprises

	2005	2010
United Kingdom	90	80
Norway	86	n.a.
Denmark	85	n.a.
Austria	81	87
Sweden	78	87
Finland	77	74
Netherlands	75	79
France	74	76
Slovenia	73	68
Czech Republic	72	72
Luxembourg	72	71
Germany (until 1990 former territory of the FRG)	69	73
Estonia	67	68
Ireland	67	n.a.
Belgium	63	78
Slovakia	60	69
European Union (27 countries)	60	66
Croatia	n.a.	57
Cyprus	51	72
Hungary	49	49
Spain	47	75
Lithuania	46	52
Malta	46	54
Portugal	44	65
Romania	40	24
Latvia	36	40
Poland	35	22
Italy	32	56
Bulgaria	29	31
Greece	21	28

source: Eurostat 2013, table: trng_cvts02

3. Research questions

The aim of this paper is to add to the deficient literature on CEE apprenticeship training and test the effects of workplace-based training on labor market entrance within this area as well. A new individual panel database, the Hungarian Life Course Survey (HLCS), provides an exemplary possibility to perform the analysis. While the analyses below are not *per-se* causal, my aim is to convince the reader that controlling for a wide variety of observable individual characteristics and track and occupation and school effects tackles the important endogeneity concerns.

In Hungary every student in the “lowest” non-college bound vocational training track had to do at least two years of practical training, which could either be done in the school or at a firm (see the description of the Hungarian VET system below).⁵ This study compares these two groups of students. Hence the “treatment” and the “control” groups are quite obvious: both groups have received exactly the same general training (the first two years in the vocational training program), and – provided they aim for the same occupational qualification – they have to fulfill the same requirements; the only difference between the groups is the place where practical training takes place. Although the allocation of students between training places might not be random, the HLCS offers an exceptionally wide variety of individual controls, which reduces the omitted variable bias concern. The database also includes information on the types of qualification that students have acquired, and on the schools of the students, which allows for within industry and within school analysis, that further strengthens the reliability of the estimates. Moreover, the HLCS is a panel database, which rules out the problem of reverse causality.

4. Previous research on causal effects

There are but a handful of empirical studies that offer analysis of the causal effects of apprenticeship training on individual level labor market outcomes (see review by Wolter and Ryan 2011). These analyses almost exclusively predict that apprentices benefit from workplace-based training, in that their initial employment probability is higher, but their foci, methods, additional tests, and conclusions differ.

A study by Bonnal, Mendes and Sofer (2002) comes closest to the approach and focus of this paper. Bonnal et al. (2002) look at the French dual system and compare apprenticeship and vocational school graduates. They try to take the selection to apprenticeship into account by simultaneous maximum likelihood estimation, where they estimate the apprenticeship choice together with the other regressions on the exit from schooling, on the exit from unemployment and on staying in one’s training firm. Although their data is also an individual panel with detailed employment record for one and a half years after graduation, they can only control for the father’s employment situation and the region, and not for school achievement or ability. Their results show that apprentices have a better chance of finding a job immediately after graduation, but this effect is mainly driven by the “stayers”, i.e. those that stay at the firm that provided the training. Female apprentice “movers” have the same (or lower) employment probability than non-apprentice vocational students, while male “movers” also have lower employment probability than “stayers”, but similar or higher than non-apprentices.

⁵ Note that the newly enacted law on Vocational Education (2011/CLXXXVII) has changed the system extensively, but these changes fall outside the time horizon covered by this study.

The authors argue that this finding could be due to three distinct reasons, among which they are unable to discriminate: a) apprentices might lack the general human capital, as opposed to non-apprentice VET students, and thus finding a job at a firm other than their training firm is harder/not-easier; b) “movers” might be negatively selected, as those who are not hired by the training firm might have some unobserved negative trait; and similarly c) there might be a negative signaling effect associated with moving to another firm, even if “movers” are not different from “stayers” in other respects.

A similarly designed study is Bertschy, Cattaneo and Wolter (2009), who look at the Swiss dual system. They also use a panel which is connected to the PISA 2000 Swiss database, which provides standardized test scores to proxy student achievement as well as socio-economic status and other controls, and they also use simultaneously estimated equations to take selection into account. However, since the vast majority of the Swiss vocational students (over 90%) are in the dual apprenticeship training, they compare apprentices, who taken up training with “higher intellectual level”, with the others. Also their utilized outcome is not employment, but employment in “adequate job” that matches the graduates’ qualifications. Initially they find a significant difference between these two groups, which disappears after they take selection into tracks into account. They emphasize that self-selection into educational tracks is very important. In fact, students with higher PISA literacy scores are less likely to drop out, and more likely to enroll in a vocational field with a higher intellectual level. The level of literacy does not have a direct effect on the probability of finding an adequate job, but only through the vocational track choice.

The only paper using data from a CEE VET system is the one by Noelke and Horn (2011), which also uses Hungarian data, but its approach and time of investigation are different. They conclude that apprentices are less likely to be unemployed after they enter the labor market, but this effect fades out some time after entry into the labor market. The authors find no differences in the quality of job acquired in the labor market.

Parey (2009) also uses variation in the supply of apprenticeship places in local German labor markets as an exogenous predictor for individuals’ choice between firm-based apprenticeship training and fully school-based vocational program, to identify the returns to apprenticeship training. Similarly to the above listed papers, he shows that apprenticeship training leads to substantially lower unemployment rates, which fade out over time.

The current paper backs up these studies, in finding a positive effect of workplace-based training on employment chances.

5. A non-dual CEE system - the Hungarian VET system

While most of the studies that have addressed the question of the effectiveness of apprenticeship training are based on countries with dual systems, the Hungarian VET also allows for a within track comparison of workplace-based and school-based training. As a non-dual system this country study should especially be important for countries with less experience in apprentice training. Thus findings from a non-dual system, where the workplace-based training is still widely utilized, could be informative for those countries where apprenticeship training is less widely spread but its development is considered.

Also, as van de Werfhorst and co-authors (van de Werfhorst 2011b; Bol and van de Werfhorst 2011; van de Werfhorst 2011a) have pointed out different theories might explain better the education-labor market link in different countries or in different labor market settings. Specifically van de Werfhorst (2011b) argues that in dual systems the human capital theory is more adequate, since there is a stronger match between the skills acquired in education and skills needed on the workplace. In countries with less evident link between labor market and education, other indicators of skills – such as general literacy or numeracy – are more important, and thus educational attainment is less important. Although in his comparative studies (van de Werfhorst 2011b; Bol and van de Werfhorst 2011) Hungary is considered as a strongly vocationally oriented country, and as such is grouped with the dual systems, I argue that since the Hungarian system is highly decentralized, with very weak links to the labor market, hence Hungary has a non-dual education system. This feature – being non-dual but still large share of apprenticeship training within a large vocational sector – allows for an important test that might hold for other non-dual systems, had the share of vocational education (and specifically the workplace-based training) been extended.

The Hungarian education system resembles that of the post-Soviet systems (see figure A1 in the appendix). Most students choose between three tracks at the end of their 8th grade:⁶ an academic track (*gimnázium*), and two vocational tracks. The vocational secondary track (*szakközépiskola*) mixes academic and vocational training and allows for tertiary entrance after graduation, while the vocational training track (*szakiskola*) is non-college bound, but vocational practical training, either in the form of school-based or workplace-based training, is compulsory. In 9th grade a little more than 35% of the cohort is in academic secondary tracks. Another 60% of students go to vocational tracks: a large majority of them (over 40% of the full cohort) enter the vocational secondary, while around 20% enter the vocational training track. The remaining less than 5% of students are dropouts,

⁶ About 8% of each cohort enters the so called early-selective academic tracks after 4th or after 6th grade, thus students are already enrolled here at the end of their 8th grade. More on this see Horn (2013a).

repeaters, or those students with special educational needs (SEN), who cannot be integrated with the others and thus enrolled in special vocational training. While both the academic and the vocational secondary tracks offers general training for four years - and the vocational secondary offers pre-vocational training, with usually one or two optional years of vocational practical training after the school-leaving exam – the vocational training track has so far offered only two years of general training⁷ with two additional years of practical training.

This paper focuses on the 20%, who are enrolled in the vocational training (VT) track. This track is considered to be the lowest ranked in the hierarchy of tracks (but still above no-education). This paper compares VT students who have done practical training at a private firm with those, who have done practical training within schools.

Although the selection into workplace-based training might not be random, there is no central procedure that allocates students in one group or in another. In fact, the organization of the system is overly school-based, with relatively few links to the labor market (Kis et al. 2008). The system has been one of the most decentralized ones in the OECD (OECD 2004). It is the duty of the school to provide practical training for the student. The school can either organize the training within its boundaries (e.g. by hiring vocational teachers) or can “outsource” the training to a private firm, which can be done in groups or individually as well. The student can also organize training for her/himself at a private firm. In all of these cases a tripartite contract must be signed between the firm, the school and the student.

Firms also have (small) incentives to train students. All firms have to pay a contribution towards vocational training (a tax), which is 1,5% of the sum of the gross wages of the firm. Firm with less than 50 employees can use 60%, while larger firms 33% of this amount to train their workers, including training apprentices. Apprenticeship students have to be paid at least 20% of the minimum wage while in training,⁸ which amount is deductible from the contribution towards vocational training. Some further costs, such as the foregone earning of the trainers at the firm or some material costs can also be deducted.

So Hungary is an ideal place to test the pure effect of workplace-based training in non-dual systems: not high but existing incentives for firms to train, basically non-existent compensation for apprentices and two ideal groups to compare, both of which receive the same general training but differ in their place of practical training. The only open question is, how VT students are allocated

⁷ The system has changed only recently, where general training has been reduced immensely and practical training introduced in the first two years as well.

⁸ This amount is close to nothing. The minimum wage in 2010 was 73500HUF that is approximately 260-270 EUR/month. Correspondingly, the average amount the apprenticeship students received in our data was 15361 HUF (~55 EUR) a month with a standard deviation of 5691 HUF.

between workplace-based and school-based training. After the introduction of the HLCS data, I will address this question.

6. The HLCS data

The Hungarian Life Course Survey (HLCS) is an individual panel survey conducted annually. The original sample of 10,022 respondents was chosen in 2006 from the population of 108,932 eighth grade students with valid test scores from the National Assessment of Basic Competencies (NABC). The NABC measures the literacy and numeracy of all 6th, 8th and 10th grade students every year, starting from 2006 (OECD 2010). The NABC also contains a set of family background variables, such as parental education or employment status. The first HLCS survey wave was completed during the winter of the school-year 2006/7, and subsequent waves have been fielded on a yearly basis. Currently there are 6 waves available with fairly large response rates. The annual sample attrition rate, on average, is only around 5% (see Table 3).

Table 3. Basic statistics of the HLCS database

wave	School year	Date of the survey	Median school grade	Number of students (with oversampling SEN students)	Number of students (representative sub-sample)
1	2006/07	2006 fall	9	10022 (100%)*	7218 (100%)
2	2007/08	2007 fall	10	9300 (92,8%)	6716 (93%)
3	2008/09	2008 fall	11	8825 (88,1%)	6397 (88,6%)
4	2009/10	2009 fall	12	8333 (83,1%)	6071 (84,1%)
5	2010/11	2011 spring	13 (LM entry, post-secondary vocational or tertiary)	7662 (76,4%)	5587 (77,4%)
6	2011/12	2012 spring	14 (LM entry, post-secondary vocational or tertiary)	6974 (69,5%)	5111 (70,81%)

Note: LM = Labor Market

* The sample was selected from a population of 108932 students taking the NABC test, from whom 37027 students have indicated to be available for such a panel study. Of the initial 10000 sample 1484 were unsuccessful for various reasons (the most populous reasons are: refuse to answer: 726, not available during the survey period: 143, moved: 131, four unsuccessful approaches: 143) and thus additional sample units from the given sampling unit was approached (more on this see Kézdi, Molnár, and Medgyesi 2007, in Hungarian)

The HLCS database contains detailed information on achievement (standardized literacy and numeracy scores in 8th grade from the NABC data as well as teacher given class marks in each year), ethnicity, school trajectory, family background – including parental education and employment –, and many other dimensions. The main blocks are family and financial situation, parents' work history, studies/school results, track change/dropout, labor market, and data on partner/child. Although

students with special educational needs (SEN) are overrepresented in the data, propensity weights are used to control for the oversampling, as well as for the imminent sample attrition. The following strata were used during the data collection, and in estimating the weights: 1) 3 settlement types: the capital and big cities, other cities, villages 2) 7 NUTS-2 regions⁹ 3) Reading literacy test scores (30 equal groups from the NABC 2006 reading literacy distribution).

The most important variables of interest in this paper are the school track, the apprenticeship status, and the labor market outcome. School track is defined as the student's school track in the 4th wave of the study, the year when the median student was finishing the last year of compulsory schooling. All students in the analysis were enrolled in the vocational training track in the 4th wave. Vocational training students could either do their practical training within school in class, or in a school workshop, or could go to a private firm, either with the help of the school (usually in groups), or by organizing the training by themselves. I have labeled the former two as school-based and the latter two as workplace-based training. Anyone, who did workplace-based training in the 4th wave or in the 5th wave of the study (the year after finishing compulsory education), is considered an apprentice.¹⁰ The four types of labor market outcomes – employed, unemployed, studying and other¹¹ – are considered in the last (available) wave of the study, and are self-declared. The main reason for using the 6th wave and not the 5th wave, which is the one after the compulsory education ends, is that the vast majority of students in the 5th wave were still in education, even among the vocational training students (see Table 4). By the 6th wave the majority of vocational training graduates have entered the labor market (as employed or unemployed) and less than a quarter of them are still in school (e.g. in further training or switching to tracks leading to the school leaving exam).

⁹ The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU.

¹⁰ Although students could have done workplace-based training in the 3rd wave of the HLCS study, this information is unfortunately not available.

¹¹ The four possible options within the other category are: disabled, on maternity-leave, caring for family and other reasons.

Table 4: Labor market outcomes in the 5th and 6th wave

	5th wave						6th wave					
	work	unempl.	study	other	missing	Total	work	unempl.	study	other	missing	Total
academic	70	54	1717	62	172	2075	187	95	1419	85	289	2075
%	3,37	2,6	82,75	2,99	8,29	100	9,01	4,58	68,39	4,1	13,93	100
voc.sec.	106	115	2037	62	158	2478	452	303	1219	161	343	2478
%	4,28	4,64	82,2	2,5	6,38	100	18,24	12,23	49,19	6,5	13,84	100
voc.tr.	148	189	958	62	114	1471	541	290	286	123	231	1471
%	10,06	12,85	65,13	4,21	7,75	100	36,78	19,71	19,44	8,36	15,7	100
spec.voc.tr.	23	34	191	12	26	286	60	45	108	25	48	286
%	8,04	11,89	66,78	4,2	9,09	100	20,98	15,73	37,76	8,74	16,78	100
missing	252	418	906	246	1890	3712	508	408	515	262	2019	3712
%	6,79	11,26	24,41	6,63	50,92	100	13,69	10,99	13,87	7,06	54,39	100
Total	599	810	5809	444	2360	10022	1748	1141	3547	656	2930	10022
%	5,98	8,08	57,96	4,43	23,55	100	17,44	11,38	35,39	6,55	29,24	100

Other variables that are used are the standardized test score (literacy and numeracy) in 8th grade,¹² class mark averages (1- fail to 5- excellent) in 8th and in 12th grade, gender, SEN status, Roma ethnicity, parental education and occupation. All control variables are from the first wave of the study, unless otherwise noted. Additional controls are a proxy for grade repetition (whether the student was in the 12th grade in the 4th wave of the study) and a proxy for motivation (whether her/his 9th grade school was her/his first choice). The size of the training firm (small: 1 to 12 employed, medium: 13 to 100 employed and large: over 100 employed) is also used in some estimations. The month of survey is controlled in all estimations and is not shown. See Table 5 for descriptive statistics.

Table 5: Descriptive statistics – data available for students in the 6th wave of HLCS

Vocational training students only						
Variable	obs.	weighted obs.	mean	s.d.	min.	max.
apprentice, 4 th or 5 th wave	1183	15048	0.60	0.49	0	1
math test score (std.), 8 th grade	1087	14180	-0.83	0.68	-2.74	2.10
reading test score (std.), 8 th grade	1217	15447	-0.92	0.68	-3.78	1.21
class mark average, 8 th grade	1170	14883	3.18	0.53	1	5
class mark average, 12 th grade	1217	15447	3.32	0.58	2	5
female	1194	15143	0.35	0.48	0	1
SEN student	1216	15437	0.09	0.29	0	1
Roma	1217	15447	0.09	0.29	0	1
parents' ed.: below primary	1214	15412	0.02	0.15	0	1
parents' ed.: primary	1214	15412	0.20	0.40	0	1
parents' ed.: vocational	1214	15412	0.48	0.49	0	1
parents' ed.: secondary	1214	15412	0.25	0.43	0	1
parents' ed.: tertiary	1214	15412	0.05	0.22	0	1
father employed, 4 th wave	1215	15424	0.52	0.50	0	1
father unemployed, 4 th wave	1215	15424	0.23	0.42	0	1
12th grader in 4th wave	1217	15447	0.78	0.41	0	1
9th grade track is first choice	1196	15210	0.73	0.44	0	1

note: all data are available for 964 students, corresponding to a weighted number of 12649 students.

All schools that offer training have to state the profession for which they are training, based on which students can choose schools. Most professions are included in the National Training Register (Országos Képzési Jegyzék - OKJ). The HLCS also contains information on the type of the qualification for vocational graduates, although the number of missing cases is high (see Table 6). Of the 1,471 VT

¹² Note that these test scores cannot be used for the secondary level entrance, but are used to make schools accountable and to provide feedback for the teachers (see OECD 2010).

students only 964 has this information in the dataset. The official list of OKJ qualifications contains 21 larger categories. I have grouped these into 6 broad categories (industries) in order to increase the number of cases within each category, but still facilitate relevant comparison between the groups (see Table A1. in the appendix).

Table 6.: Number and percentage of VT students in school- and workplace-based training by industry

Industry	school-based	work-based	missing	Total
social services	3	6	0	9
%	33,33	66,67	0	100
mechanics	108	112	4	224
%	48,21	50	1,79	100
industry	124	106	2	232
%	53,45	45,69	0,86	100
transport-environment	13	19	0	32
%	40,63	59,38	0	100
services	121	267	7	395
%	30,63	67,59	1,77	100
agriculture	43	29	0	72
%	59,72	40,28	0	100
missing	178	296	33	507
%	35,11	58,38	6,51	100
Total	590	835	46	1471
%	40,11	56,76	3,13	100

7. Selection into apprenticeship

Before addressing the effectiveness of the apprenticeship training it is essential to understand, which student chooses workplace-based and which chooses school-based training. There is only anecdotal evidence about the process of apprenticeship selection, and thus endogeneity cannot be ruled out: students, who would more likely be employed at the end of the education, are also more likely to get an apprenticeship position. It is not unlikely that apprentices have different personal traits than non-apprentices, but it is also highly likely that the local labor market (the demand side), as well as the occupation of the trainee (the supply side), has an effect on the probability of employment.

In Table 7 linear probability models are used to assess the strength of association between personal traits and training provisions. The fit of the linear models can be interpreted more straightforwardly than the fit of the non-linear models and within groups weights cannot be used in fixed-effect logit models.¹³

¹³ Using fixed effect logit models on a representative subsample of the HLCS provides substantially the same results (Horn 2013b).

Covariates that are significant in the first estimation (Table 7 column 1) suggest that higher skilled students are more likely to enter apprenticeship training. The within industry estimation (column 2) as well as the within school estimation (column 3) do not show these strong skill differences between apprentices and non-apprentices, suggesting that the (self)selection into occupations or more likely into schools drives the results. That is, there might be some occupations and/or schools that attract better students (see also Bertschy, Cattaneo, and Wolter 2009). The base (column 1) and the within school estimations (column 3) also show that people with less educated parents are more likely to have practical training at private firms. The results in the most restrictive within school and within occupation model (column 4) however highlight that none of the individual traits matter if occupational differences and school and/or local labor market effects are taken into account.

Individual traits explain only 4% of the variation of the base model, but industry effects add an additional 4%, suggesting that students in different occupations have different chances of getting into apprenticeship (see also table 6). The inclusion of school fixed effects in the model increases the fit tremendously. The school fixed effect model explains almost 50% of the variance, which is further increased to 73% when industry fixed effects are added. This is of course not surprising, given that the sample was not representative on the school level and thus there are on average less than 4 students per school in the sample, which further decreases when within industry effects are considered within schools.

Nevertheless, it seems that while on the national level there are very small but observable differences between the average personal traits of apprentices and non-apprentices, these observable differences seem to fade away within school and within industry, suggesting that the industry and especially the school (and the local labor market) matters much more than individual traits.

Table 7: Selection into apprenticeship – linear probability models

	(1)	(2)	(3)	(4)
class mark average, 8th grade	0.0914** (0.0413)	0.0321 (0.0505)	0.0289 (0.0444)	-0.0428 (0.0794)
class mark average, 12th grade	-0.0124 (0.0334)	-0.0118 (0.0396)	0.0611 (0.0377)	0.0925 (0.0626)
math test score (std.), 8th grade	-0.0141 (0.0318)	-0.00424 (0.0378)	-0.0280 (0.0318)	-0.0182 (0.0530)
reading test score (std.), 8th grade	0.0624** (0.0308)	0.0337 (0.0406)	0.0263 (0.0338)	-0.0380 (0.0652)
parents' ed.: primary or below	0.0866* (0.0482)	0.0689 (0.0625)	0.134*** (0.0513)	0.0927 (0.0912)
parents' ed.: secondary or higher	0.0151 (0.0437)	0.0260 (0.0521)	0.00147 (0.0456)	0.0226 (0.0782)
father employed, 4th wave	-0.0553 (0.0437)	-0.0292 (0.0526)	-0.0711 (0.0487)	-0.105 (0.0877)
father unemployed, 4th wave	-0.0270 (0.0508)	-0.00995 (0.0667)	-0.0469 (0.0539)	0.00422 (0.0911)
SEN student	0.0294 (0.103)	0.0210 (0.0935)	0.0795 (0.103)	0.0878 (0.172)
Roma	-0.0429 (0.0647)	-0.0581 (0.0862)	-0.0223 (0.0655)	0.103 (0.119)
9th grade track is first choice	0.0323 (0.0426)	0.0775 (0.0549)	0.0531 (0.0441)	0.104 (0.0743)
12th grader in 4th wave	0.142*** (0.0476)	0.151*** (0.0547)	0.0481 (0.0483)	0.0822 (0.0768)
female	0.0159 (0.0406)	-0.0680 (0.0581)	-0.0230 (0.0421)	0.00427 (0.0856)
Constant	0.270 (0.168)	0.412** (0.209)	0.267 (0.171)	0.305 (0.319)
Observations	968	679	961	679
R-squared	0.0394	0.089	0.484	0.733
Industry FE	no	yes	no	yes
School FE	no	no	yes	yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

month of survey is controlled for

8. Does workplace-based training increase labor market outcomes?

The base model is a multinomial logit model with all four possible outcomes: employed, unemployed, studying, and other. Due to the fact that the independent variables are measured before the dependent variable, reverse causality is unlikely. In order to minimize omitted variable bias, all controls presented in Table 5 are included group-by-group in Table 8 and 9. In the first estimation (Table 8 block 1) only the apprentice variable is included, in the second (block 2) measures of skills (test scores and class marks) are also controlled for, while in the third (3) the social background characteristics and other controls are included. Note that apprenticeship training is

significant in all three estimations, and show, that those VT students who had carried out practical training at a private firm, as opposed to doing practical training in school, have around 1.5-1.6 times higher odds of being employed, as opposed to being unemployed. The size of this effect is unchanged by any of the personal traits that are included in the model. On the other hand social background, gender and grade repetition matters in getting a job. It seems that students with employed fathers have much higher odds of being employed; whether this effect materializes through socialization or through social networks is not obvious. Also men are more likely to be employed and women are more likely to fall into the other category (e.g. maternity leave). Students, who have not repeated grades until 12th grade, are also more likely to be employed in the 6th wave of the study. Note, however, that none of the school achievement variables – neither the standardized test scores, nor the teacher given class marks – seem to be relevant in employment, although students with higher class marks are more likely to study than to be unemployed.

Table 9 adds further controls to the base model. Table 9 block 1 is the same as Table 8 block 3 to facilitate comparison of models. Table 9 block 2 shows the same multinomial logit model with industry fixed effects added,¹⁴ while dummies of the training firm size are used in block 3 instead of the apprenticeship dummy. The main conclusion does not change even if these controls are added: apprentices have significantly higher odds to be employed vs. being unemployed than those with only school-based vocational practice, although the effect increases slightly.

Although it seems that apprentices in all sizes of firms have higher odds to be employed than non-apprentices, the significance of the general effect seems to be driven by the medium sized firms. Apprentices in firms with employees between 13 and 100 have almost 4 times higher odds of being employed than non-apprentices, while the corresponding odds of smaller and larger firms are 1.5 and 1.7, respectively, but non-significantly different from zero on conventional levels.

¹⁴ Due to the large missing values of industry codes I recalculated the sample weights with the inverse ratio of having a qualification using the original sampling strata.

Table 8: Effects of apprenticeship training, base model - multinomial logit model, odds of being employed, studying or other wrt. being unemployed

	(1)			(2)			(3 – the base model)		
	work	study	other	work	study	other	work	study	other
apprentice, 4 th or 5 th wave	1.489** (0.264)	1.149 (0.232)	1.226 (0.319)	1.457* (0.283)	0.975 (0.216)	1.179 (0.324)	1.648** (0.335)	1.106 (0.253)	1.211 (0.401)
class mark average, 8th grade				1.186 (0.258)	1.367 (0.325)	1.373 (0.438)	1.210 (0.265)	1.347 (0.312)	1.384 (0.534)
class mark average, 12th grade				1.136 (0.197)	1.636** (0.323)	1.597* (0.386)	1.056 (0.188)	1.618** (0.320)	1.344 (0.436)
math test score (std.), 8th grade				1.170 (0.221)	1.062 (0.216)	0.720 (0.184)	0.963 (0.184)	0.972 (0.203)	0.974 (0.272)
reading test score (std.), 8th grade				0.724* (0.128)	1.023 (0.209)	0.897 (0.233)	0.797 (0.144)	1.064 (0.217)	0.681 (0.203)
parents' ed.: primary or below							0.624* (0.167)	0.529** (0.157)	0.789 (0.317)
parents' ed.: secondary or higher							0.985 (0.235)	1.243 (0.341)	1.534 (0.712)
father employed, 4th wave							1.841** (0.443)	1.247 (0.343)	1.707 (0.693)
father unemployed, 4th wave							0.927 (0.254)	0.685 (0.216)	0.839 (0.365)
SEN student							0.807 (0.413)	0.851 (0.490)	8.19e-08*** (5.52e-08)
Roma							0.877 (0.289)	1.071 (0.433)	3.538*** (1.525)
9th grade track is first choice							1.015 (0.231)	1.017 (0.259)	1.084 (0.406)
12th grader in 4th wave							1.851** (0.483)	0.603* (0.161)	0.730 (0.279)
female							0.539*** (0.124)	0.987 (0.257)	10.18*** (4.456)
Constant	1.487*** (0.193)	0.923 (0.137)	0.349*** (0.0640)	0.501 (0.415)	0.0786*** (0.0754)	0.0190*** (0.0207)	0.372 (0.328)	0.154* (0.158)	0.00588*** (0.00820)
Observations	1,183	1,183	1,183	1,025	1,025	1,025	964	964	964

Standard error in parentheses, *** p<0.01, ** p<0.05, * p<0.1, ORs reported, reference category is *unemployed*. The month of the survey is controlled for

Table 9: Effects of apprenticeship training, industry FE - multinomial logit model, odds of being employed, studying or other wrt. being unemployed

VARIABLES	(1 – the base model)			(2)			(3)		
	work	study	other	work	study	other	work	study	other
apprentice, 4 th or 5 th wave	1.648** (0.335)	1.106 (0.253)	1.211 (0.401)	1.826** (0.479)	0.978 (0.275)	1.329 (0.594)			
apprentice firm size, small (1-12) ⁺							1.496 (0.477)	0.790 (0.276)	0.983 (0.637)
apprentice firm size, medium (13-100) ⁺							3.926*** (1.663)	2.275* (1.039)	5.083** (3.246)
apprentice firm size, large (100+) ⁺							1.703 (0.597)	0.937 (0.381)	0.799 (0.573)
Constant	0.372 (0.328)	0.154* (0.158)	0.00588*** (0.00820)	0.103 (0.153)	0.563 (0.863)	0.0572 (0.148)	0.0739* (0.112)	0.457 (0.705)	0.0450 (0.109)
Industry FE	no	no	no	yes	yes	yes	yes	yes	yes
Observations	964	964	964	679	679	679	670	670	670

Standard error in parentheses, *** p<0.01, ** p<0.05, * p<0.1, ORs reported, reference category is *unemployed*. The month of the survey is controlled for. All variables - as in Table 8 block 3 - are included in the models and are not shown. ⁺Reference category is the non-apprentice

Table 10 shows the predicted probabilities and marginal effects of apprenticeship training. The baseline uncontrolled average probability of being employed for a VT student in 2011 is 44%. Apprentices, however have a 47.1% chance, while school-based trained students have a 39.6% chance of being employed. The chances of being unemployed is the reverse: apprentices have a 21% chance, while the others have a 26.5% chance. There are no differences in the uncontrolled average baseline probabilities of the other two outcomes between the two groups (study: 24%, other: 9%). Using the base model (Table 8 block 3) to predict the probabilities at the population means similar but somewhat higher percentages are gained. The predicted a probability of being employed for apprentices is 52.3%, while for the school-trained it is 41.4%; the marginal effect of being trained at a private firm is thus 10.9 % at the mean. In other words, the average apprentice has about 11% higher chance of being employed after graduation than the average non-apprentice. This effect is somewhat lower for the top of the distribution students (high class mark averages, high literacy and numeracy, and parents with secondary general or tertiary schooling) and higher for the lower status lower skilled students (low class mark averages, low literacy and numeracy, and parents' education primary or below). While the former group has 8.7% higher probability of being employed the latter has 11.5%. The marginal effects are also larger for apprentices, who were trained in mid-sized firms. The average marginal effect here is 19%, but bottom of the distribution students benefit more (25.7%) than top of the distribution students (14.5%). This result suggests that apprentice training might be more beneficial for the lower status children, although note that students in the sample – who attend vocational training schools – are already from the bottom of the social distribution, and thus the top of the distribution students might be a specially selected bunch.

Although the probability of being employed differs a lot between industries, the effect of workplace-based training remains stable across industries (see table 10). The average apprentice has about 15% higher chance of being employed as compared to a non-apprentice with similar occupational qualifications. This effect is also very stable for the top as well as for the bottom of the distribution students, suggesting that there are important compositional differences between occupations.

Table 10: Predicted probabilities and marginal effects

	Predicted probability		Marginal effect		
	school-based training	workplace-based training	workplace-based training		
	at population mean		at population mean	For a low achiever low status student*	For a high achiever, high status student**
uncontrolled	39.6	47.1	-	-	-
base model	41.4	52.3	10.9	11.5	8.7
with industry FE	35.6	50.4	14.8	14.9	13.4
at a medium size firm	34.9	53.9	19.0	25.7	14.5
within industry					
	at population mean		at population mean	at industry mean	
social services	13.9	23.0	9.4	14.6	
mechanics	39.8	54.9	15.2	14.8	
industry	36.7	51.6	15.0	15.2	
transport-environment services	44.9	60.3	15.3	15.3	
agriculture	28.0	41.5	13.8	15.3	

* class mark averages =2, standardized test scores=-1, highest parental education= primary or below, non-SEN, non-Roma, non-repeater, current track is first choice, male

** class mark averages =5, standardized test scores=1, highest parental education= secondary or above, non-SEN, non-Roma, non-repeater, current track is first choice, male

9. Robustness checks

Although reverse causality is not likely in the base model, robustness checks could further underline that the results are not driven by the model specification, by omitted variables or by the time of the measured outcome.

Firstly, apprentice and non-apprentice students were matched with propensity score matching (nearest neighbor matching) using all variables in the base model (Table 8 block 3) as well as using industry fixed effects. For propensity score matching the four category outcome had to be transformed to binary: employment chances are compared to the joint chance of the other three categories. The results – not presented here in detail – underline that average treatment effects are highly significant and a bit larger than in the multinomial logit models: apprenticeship students on average are 16.5-17% more likely to be employed, which increases to a 19% average treatment effect within industry.¹⁵ Hence it is not the functional form specification that drives the results.

The second robustness check adds school fixed effects to the base model as well as to the industry fixed effect model. Looking at differences within schools is an especially strong test of the effect of

¹⁵ It differs a bit across industries: mechanics: 23,8%, industry: 11,5%; transport-environment: 30,8%, services: 19,7%; agriculture: 21,9%. These effects are not significantly different from each other.

apprenticeship training, since it controls for both local labor market effects as well as potential differences between school qualities. Note that the HLCS has not used schools as sampling units, thus the fact that some students are from the same school is chance only. There are 16 schools with only one student in the sample. The average school has 3.7 students in the sample, which further decreases to 3.1 if industry fixed effects are included. Taking missing values as well as the variance of the outcome measure within school into account, and the fact that a representative subsample should be used due to problems of weighting in fixed-effects logistic regressions, little less than 100 schools would be left for a non-linear analysis.¹⁶ Also since the multinomial logit model with a large number of fixed effects has not yet been fully developed (see Pforr 2011), linear probability models were estimated for this robustness check.¹⁷ The four category outcome of employed, unemployed, study or other was transformed into a binary as in the propensity score matching test (employed vs. everyone else).

The effect of apprenticeship training halves within schools, and loses its significance if school fixed-effects are included in the linear model (Table 11). Apparently, the average apprenticeship student does not have a greater chance of being employed than the average non-apprentice if they went to the same school. However this effect is driven by the size of the training firm. Apprentices, who were trained in small or in large firms, have exactly the same probability to be employed as non-apprentices, who went to their school. Students in mid-sized firms on the other hand enjoy a considerable 15-20% higher probability, even if they are from the same school and their individual traits as well as vocational qualifications are the same.

¹⁶ Fixed-effect logit regressions identify the effect only from schools, where both apprenticed and non-apprenticed students were present.

¹⁷ Non-linear robustness checks, with similar results are in Horn (2013b).

Table 11: Robustness check with industry and school fixed effects – linear probability models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
apprentice, 4 th or 5 th wave	0.0986*** (0.0380)	0.127*** (0.0464)	0.0560 (0.0477)	0.0570 (0.0629)				
apprentice firm size, small (1-12)					0.0744 (0.0477)	0.0993* (0.0567)	-0.0117 (0.0576)	0.0170 (0.0729)
apprentice firm size, medium (13-100)					0.182*** (0.0518)	0.183*** (0.0675)	0.190*** (0.0629)	0.156* (0.0877)
apprentice firm size, large (100+)					0.0559 (0.0544)	0.120* (0.0642)	0.0131 (0.0696)	0.0467 (0.0842)
Constant	0.365** (0.164)	0.0342 (0.236)	0.442** (0.183)	0.110 (0.259)	0.363** (0.166)	-0.0176 (0.236)	0.441** (0.186)	0.0614 (0.268)
Observations	964	675	957	670	936	666	929	661
R-squared	0.093	0.105	0.440	0.498	0.099	0.109	0.451	0.498
Industry FE	no	yes	no	yes	no	yes	no	yes
School FE	no	no	yes	yes	no	no	yes	yes

Dependent variable is employed=1, unemployed, studying or other =0, all variables as in the base model (Table 8 block 3) are controlled for
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The third robustness check sheds a bit of light on the firm-size puzzle. Figures 1 and 2 use another set of outcome variables. The HLCS also asks students about their employment status during the last academic year. That is, students in the 6th wave of the study, in 2012 spring, were asked whether they had had any regular job during the months between September 2010 (the start of the previous school year) and August 2011, and students in the 5th wave were asked whether they had a regular job between September 2009 and August 2010. The data is for each month in between. Figure 1 depicts the marginal effect of apprenticeship training for a male, non-Roma, non-SEN student with average class marks and test scores, parents with vocational education, who has not repeated class up until 12th grade, and applied for his track in the first place in 9th grade, filled out the survey in May 2012 and have qualification from the “average” industry. The dependent variable is 1, if the student had a regular job and 0 otherwise. Note that the outcome in May 2012 is the variable that was used as in the estimations above.

It seems that apprentices are much more likely to find a regular job right after the end of the school year. The marginal effect of apprenticeship training increases dramatically after the end of school during the summer months, and declines afterwards. This indicates that apprentice VT students have a quicker transition to the labor market than the non-apprentice VT students, but also that their advantage slowly evaporates.¹⁸ The initial effect is also quite sizeable: it is around 19% in August 2011, decreasing to 14% in 2010 May.

Figure 2 underlines that students trained in mid-sized firms are the ones, who really benefit from apprenticeship training. Apprentice students, who were trained in small firms, do not enjoy a higher probability of being employed, not even right after the school. Although the size of the effect is around 11%, which remains constant through the year, it is non-significantly different from zero on conventional levels. Conversely, apprentices in large firms seem to be hired right after graduation, and their advantage over non-apprentices are as large as 25% at the end of the summer, but this advantage drops rapidly, and loses its significance by the beginning of the next summer. Students in mid-sized firms, however, keep their significant advantage during the whole observation period, although the size of the effect also drops mildly.

¹⁸ See also a study by Plug and Groot (1998) showing that there are no long run differences in labor market outcomes between tracks.

Figure 1. Marginal effect of apprentice students having a regular job

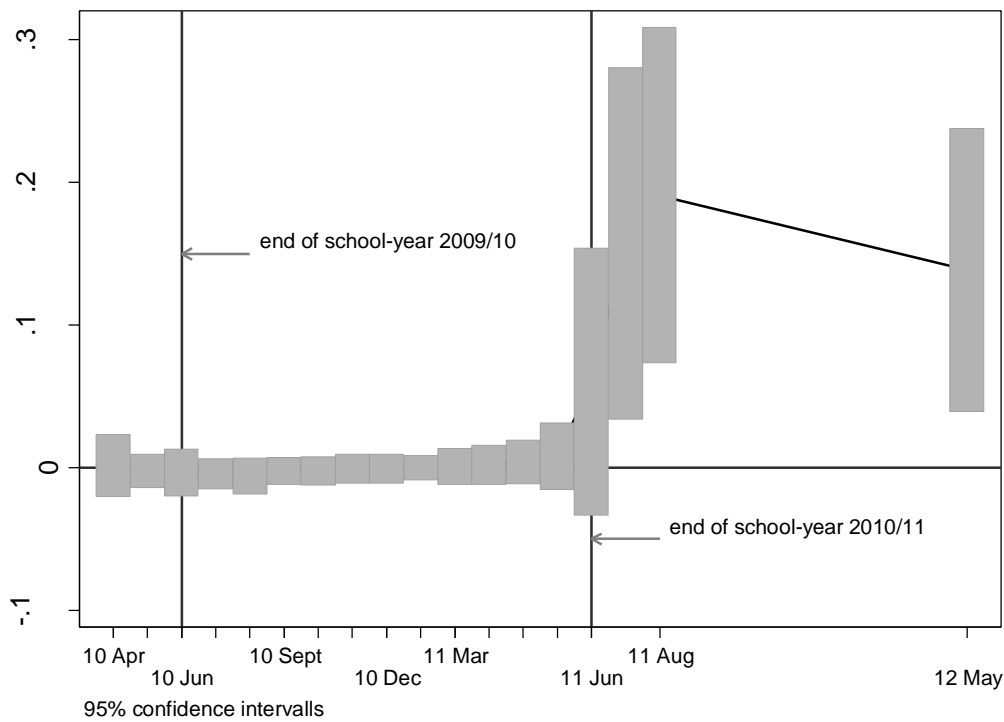
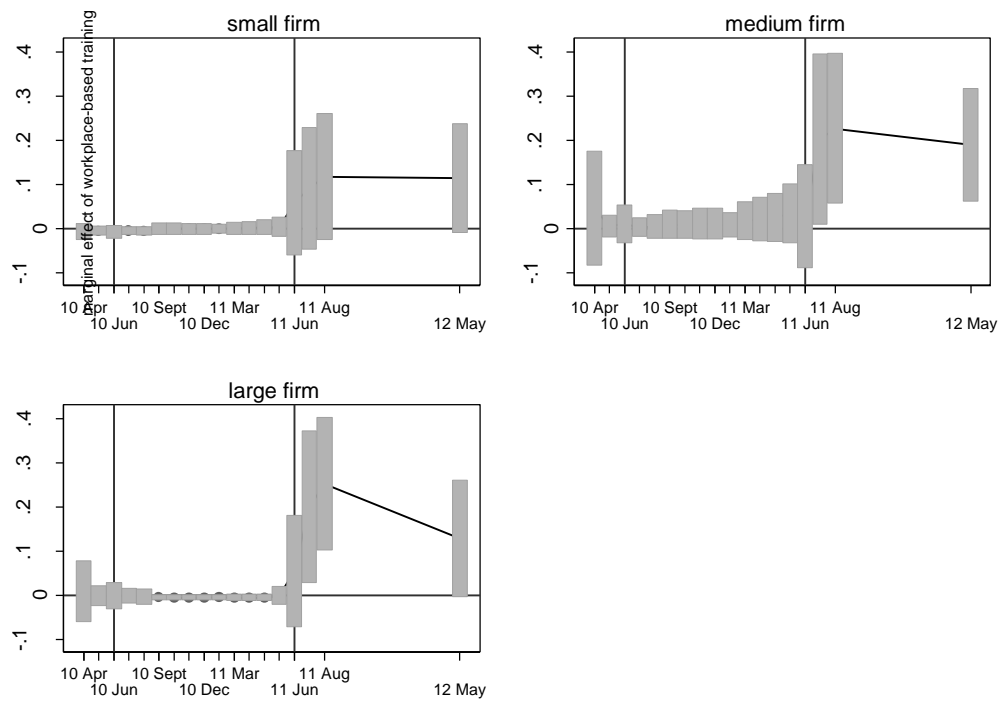


Figure 2. Marginal effect of apprentice students having a regular job in different firm sizes



Whether this effect is due to the superior specific skills that apprentices gained while being trained at the mid-sized firms, or due to the screening of these firms, is not entirely clear from these figures. Note however that the screening argument would predict an immediate and large difference between the groups – because training firms hire the best candidates right after the training – which effect should converge by time, as firms hire new employees. The human capital argument, on the other hand, would suggest a steady but continuous increase in the gap, which should only fade away after a good amount of time, when others also gain the specific skills necessary for employment. The figures, thus, support the screening rather than the human capital arguments. Also it is likely that small firms rely less on institutionalized screening processes, as they are more likely to use their social networks to recruit apprentices and thus rely less on this “probation period” and more on other information channels (e.g. take relatives or friends as apprentices in the first place). Conversely, medium or large firms are more likely to have institutionalized mechanisms for selecting apprentices and new employees. Moreover, turnover at a large firm is probably larger, at least in sheer numbers, which suggests that the potential advantage that an apprentice can gain from being selected early diminishes quickly as the firm hires new workforce. Nevertheless this analysis in itself is not enough to see whether the screening or the human capital argument comes closer to reality, and it falls outside the scope of this study.¹⁹

10. Conclusion

Although workplace-based training has long been praised for its effectiveness in preparing non-college bound youth for the labor market, there is a lack of studies that look at this question in Central and Eastern Europe, where the initial pre-war dual-training had deviated greatly from its origins due to the socialist system and the democratic transition process afterwards. Also there are only a handful of studies that try to show that the observed association between apprenticeship training and higher initial employment probability is causal.

This paper underlines the causal finding of the dual systems that workplace-based training improves initial employment chances of apprentices in a non-dual Central Eastern European setting of Hungary.

In particular, the results of this study show that Hungarian vocational training graduates, who have done their practical training at private firms, are around 10-15% more likely to be employed after

¹⁹ Note, however, that the potential mechanisms are discussed in more detail in the alternate version of this paper “The Effectiveness of Workplace-based Training in a Non-Dual Education System”, currently under review.

they finish education, than those who had their practical training in schools and are otherwise similar to the workplace-based group. The effect is net of individual skills, school attainment, parental background, motivation, gender and ethnicity, and robust to the inclusion of industry fixed effects, and for school fixed effects but only for students trained in mid-sized firms. Also results show that the significant marginal effect of apprenticeship training declines rapidly for students trained at large firms, while this decline is less marked in medium or small firm trained apprentices, suggesting that large turnover could eliminate the positive effects of apprenticeship training more quickly.

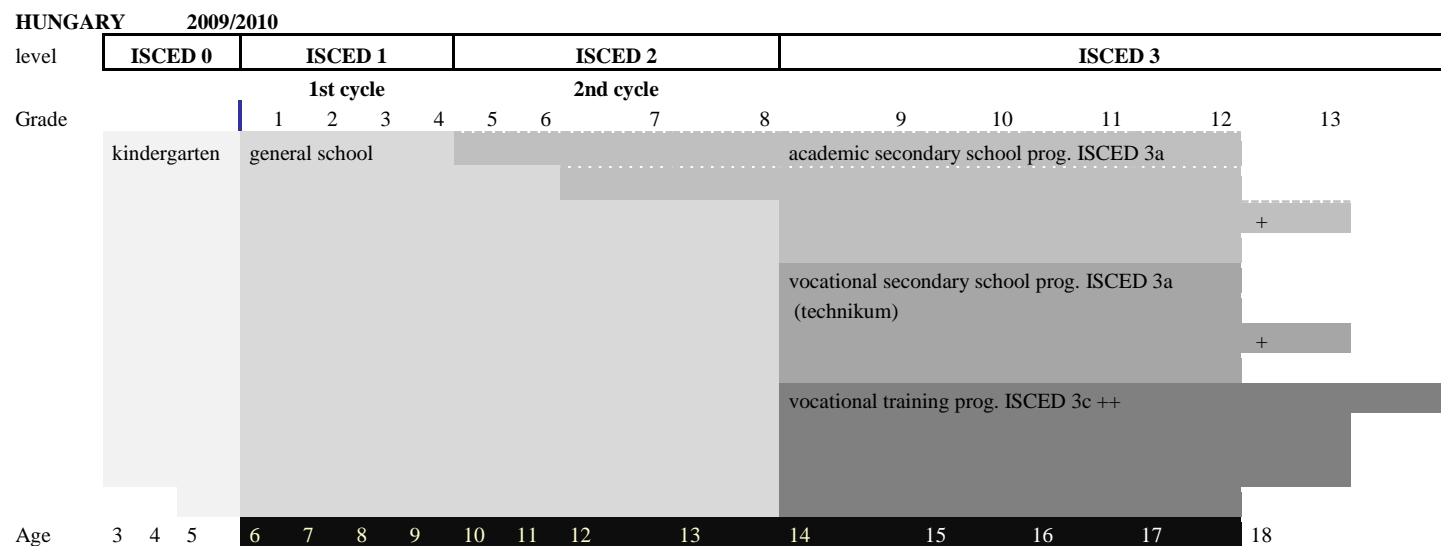
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Appendix A

Figure A.1 The Hungarian compulsory education system



compulsory education until the age of 18 applies for the 1st graders in 1998 and later (previously and from September 2012: until the age of 16)

vocational secondary school programs curriculum includes vocational subjects and many students progress to PS voc to get a VQ

+ : some schools offer an extra grade teaching a foreign language before secondary school educ. (i.e. between grade 8 and 9)

++: some programs are also available for elementary school drop-outs

ISCED	English	national language	share
0	kindergarten	óvoda	
1,2a	general school	általános iskola	100%
3a	academic secondary school prog.	gimnázium	
3a	vocational secondary school prog.	szakközépiskola	
3c	vocational training prog.	szakiskola	

Table A1: Old and new categories of the national training register (OKJ)

New categories (industries)	Original categories in the national training register
Social Services	Health
	Social services
	Education
	Art, culture, communication
Mechanics	Engineering
	Electrical-engineering, electronics
	Informatics
Industry	Chemical industry
	Architecture
	Light industry
	Wood industry
	Printing industry
Transportation-environment	Transportation
	Environment and water-management
Services	Business and economics
	Management
	Trade, marketing and administration
	Catering, tourism
	Other Services
Agriculture	Agriculture
	Food industry

Table A2: Types of training and employer firms and the number of individuals

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	mis	total		
5th wave trainer	1	Agriculture, forestry and fishing	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	12	17	
	2	Mining and quarrying	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	3	Processing	6	0	29	2	0	2	1	0	2	0	0	0	0	0	1	1	0	0	2	0	0	0	0	56	102	
	4	Electricity, gas, steam and air conditioning	1	0	0	7	1	2	0	1	0	0	0	0	0	0	2	0	0	0	1	0	0	0	1	14	30	
	5	Water supply, wastewater collection and treatment, waste management	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	
	6	Construction	10	0	17	1	1	45	1	1	1	1	0	0	1	1	4	0	1	0	5	0	0	0	0	81	171	
	7	Trade, automotive services	1	0	15	0	0	4	20	2	7	0	0	0	0	0	3	0	0	0	8	0	0	0	0	70	130	
	8	Transportation, warehousing	0	0	3	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	7	16	
	9	Hotels and restaurants, catering	2	0	10	0	0	1	17	0	64	0	0	0	0	0	0	0	1	2	5	0	0	0	0	129	231	
	10	Information, communication																										
	11	Financial and insurance activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
	12	Real estate transactions																										
	13	Professional, scientific and technical activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	14	Administrative and support service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
	15	Administration and defense, compulsory social security	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	4
	16	Education	0	0	3	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	9	15
	17	Human health and social work	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	21	24
	18	Arts, entertainment and recreation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	3
	19	Other services	2	0	7	0	3	3	5	2	8	0	0	0	0	1	3	0	1	0	19	0	0	0	1	70	125	
	20	Households as employers, producers, and service	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	21	Organizations outside Hungary																										
	22	Other																										
	23	Don't know	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	8
	missing	21	2	44	2	4	15	34	7	21	3	4	1	1	2	15	2	5	5	22	1	1	4	1	6,9	9,13		
		1		3	4	6	4	5	1	3	0			2	5	4	3	4	8	6				2	67			
	total	23	2	53	3	5	21	39	7	29	3	4	1	1	2	17	2	5	6	26	1	1	4	1	7,4	10,0		
		5		3	4	2	3	5	8	6	4	0			3	7	3	5	9	0	9	1		4	53	22		

